

IMAGE READING APPARATUS AND IMAGE FORMING APPARATUS  
PROVIDED WITH THE SAME

BACKGROUND OF THE INVENTION

5 Field of the Invention

The invention relates to an image reading apparatus and an image forming apparatus provided with the same, and particularly to an image reading apparatus provided with regulating means for  
10 regulating an original placed on an original supporting portion coming to a separating portion before a feeding operation. More particularly, the invention relates to an image reading apparatus provided with regulating means, which is inexpensive  
15 and compact and improved in a jam treating property, and an image forming apparatus provided with the same.

Related Background Art

Image forming apparatuses such as a digital copying machine, a printer and a facsimile apparatus  
20 include an image forming apparatus provided with an image forming portion and an image reading apparatus for reading an original, and designed to form an image on the basis of image information read by the image reading apparatus.

25 As such an image reading apparatus, there is one which effects, besides book original reading, i.e., reading an original by moving image reading

means from left to right and scanning the original with a book original placed on original glass, the reading of the image of an original by stopping the image reading means, and moving the original in a sub-scanning direction by an automatic document feeder (ADF) in this state, i.e., the so-called flow reading.

Fig. 10 of the accompanying drawings schematically shows the construction of a conventional image reading apparatus of such a construction, and this image reading apparatus, as shown in Fig. 10, is provided with an original feeder 500 and a reading housing portion 600. In this reading housing portion 600, there is provided a contact-type image sensor 601 for applying light from an LED array as a light source for illuminating an original to the image information surface of the original, causing reflected light reflected by the image information surface to be imaged on a sensor element by a SELFOC lens (trademark) and reading the image information.

This contact-type image sensor 601 is moved from left to right during the reading of a book original to thereby scan the book original placed on original glass 501, and is stopped at a predetermined reading position when a sheet original conveyed by the document feeder 500 is to be read by flow reading.

Also, the original feeder 500 is provided with an original tray 502 on which originals are placed, a pickup roller 503 provided at a location opposed to an upper original on the original tray 502, and a  
5 separating portion provided downstream of the pickup roller 503 and comprising a separating pad 504 and a separating roller 505. The pickup roller 503 is held for movement toward and away from the original by an arm 520 provided for pivotal movement about the  
10 center of rotation of the separating roller 505.

Further, the original feeder 500 is provided with a pair of registration rollers 506 and 507 provided downstream of the separating roller 505, a platen roller 508 provided downstream of the pair of  
15 registration rollers 506 and 507, a pair of conveying rollers 509 and 510 provided downstream of the platen roller 508, and a pair of sheet discharging rollers 511 and 512 for discharging the original. Design is made such that the original can be conveyed while  
20 being urged against the glass stand 501 of the reading housing portion 600 by the platen roller 508.

Each roller is adapted to be rotated by drive from a driving motor (not shown) being transmitted by a gear train or a timing belt, and for example,  
25 design is made such that drive is transmitted to the pickup roller 503 and the separating roller 505 through a one-way clutch (not shown) during the

forward rotation of the driving motor, and the drive  
of the driving motor is transmitted to the  
registration roller 507, the platen roller 508, the  
conveying roller 509 and the sheet discharging roller  
5 511 through a one-way clutch during the reverse  
rotation of the driving motor.

Description will now be made of the flow  
reading operation of the image reading apparatus of  
such a construction.

10           Originals are set on the original tray 502 with  
the image surfaces thereof facing down, and a start  
button (not shown) is depressed, whereupon the  
driving motor (not shown) is rotated in a forward  
direction, whereby the pickup roller 503 retracted  
15 upwardly so as not to strike against the originals  
during the setting of the originals is lowered and  
comes into contact with the originals, whereafter the  
pickup roller 503 is rotated in an original conveying  
direction and conveys the originals to the separating  
20 portion 504, 505. The originals are separated one by  
one by the separating portion 504, 505, and the  
separated original is dashed against the pair of  
registration rollers 506 and 507, which are at a halt.

          Thereafter, the driving motor is rotated in the  
25 forward direction for a predetermined time and the  
original is looped so that the skew feeding of the  
original is corrected, and then the driving motor is

stopped. Thereby, the original hits against the pair of registration rollers 506 and 507 and is stopped in that state.

Next, the driving motor is rotated in a reverse  
5 direction and the registration roller 507 is rotated, whereby the original is conveyed to the platen roller 508, and the reading of the original is effected by the contact-type image sensor with the original brought into close contact with the glass stand 501.  
10 When the original passes the platen roller 508, reading is terminated and the original is discharged onto a sheet discharging tray 518 by the pair of conveying rollers 509 and 510 and the pair of sheet discharging rollers 511 and 512.

15 When the original is thus discharged onto the sheet discharging tray, the driving motor is again rotated in the forward direction. Thereby, the next original is fed, whereafter reading is effected as described above, and this is continued until the  
20 originals become exhausted.

Now, in order to prevent the leading edges of the originals from rushing into the separating portion 504, 505 in the form of a bundle during the setting of the originals, a shutter 513 which is  
25 regulating means is provided between the pickup roller 503 and the separating portion 504, 505. This shutter 513 is adapted to be moved to a regulating

position shown in Fig. 10 in which it regulates the original rushing into the separating portion 504, 505 before the reading operation is started, and a retracted position in which it does not hamper the feeding of the original when the original is fed out to the separating portion 504, 505 by the pickup roller 503.

This shutter 513 is adapted to be selectively moved to the regulating position and the retracted position by a solenoid 514 and a link 515. That is, the original feeder 500 of such a construction has, as driving means, a driving motor for driving the pickup roller 503 and the separating roller 505, and a solenoid 514 for moving up and down the shutter 513.

On the other hand, the pickup roller 503, the separating roller 505 and the shutter 513 are supported by an openable and closable cover 516 pivotably movable in a clockwise direction about a sheet feeding drive shaft 517, and when this openable and closable cover 516 is upwardly pivotally moved and opened, the pad 504 and the separating roller 505 are adapted to be spaced apart from each other. Thereby, if the openable and closable cover 516 is opened when the original is jammed in the separating portion 504, 505, the pad 504 and the separating roller 505 become spaced apart from each other and the jammed original can be removed.

As another construction, there is proposed, for example, in Japanese Patent Application Laid-Open No. 11-143139, a construction which has a driving motor and two lines of transmitting mechanisms for dividing  
5 and transmitting the driving force of this driving motor to thereby disuse driving means (such as a solenoid) exclusively for a shutter, and performs the operation of moving up and down a pickup roller and the operation of moving up and down the shutter by a  
10 single driving means.

In such a conventional image reading apparatus, however, the shutter 513, the pickup roller 503 and the separating roller 505 are driven by discrete driving means and therefore, not only the number of  
15 parts is increased, but also an expensive electrical part such as a solenoid is necessary, and control becomes complicated. Further, a space for mounting the solenoid therein becomes necessary, and the problem of the bulkiness of the image reading  
20 apparatus also arises.

Also, in a case where as shown in Japanese Patent Application Laid-Open No. 11-143139, the shutter, the pickup roller and the separating roller are driven by a single driving motor, two  
25 transmitting mechanisms, i.e., a drive transmitting mechanism for transmitting the drive of the driving motor to thereby drive the pickup roller and the

separating roller, and a drive transmitting mechanism for performing the operation of moving up and down the shutter, become necessary and therefore, the construction of the apparatus becomes complicated and  
5 also, a number of parts become necessary. Again in this case, there are the problem of an increased cost and the problem of the bulkiness of the image reading apparatus attributable to the disposition of the drive transmitting mechanisms.

10         On the other hand, when as already described, sheet jam occurs, the openable and closable cover is opened, whereafter the jammed original is pulled out, but when the openable and closable cover is being thus opened, the shutter may hang down from gravity.  
15 If the shutter thus hangs down, not only the shutter may be caught by the original and may hinder the pulling-out of the original, but also may impart damage to the original.

## 20 SUMMARY OF THE INVENTION

So, the present invention has been made in view of such a situation and has as its object to provide an image reading apparatus provided with a shutter (regulating means) which is inexpensive and compact  
25 and improved in a jam treating property, and an image forming apparatus provided with the same.

In order to achieve the above object, in an



image reading apparatus according to the present invention provided with image reading means for reading the images of originals, and an original feeder for feeding the originals from an original supporting portion on which the originals are placed to the image reading means, the original feeder is provided with feeding means provided above the original supporting portion for movement toward and away from the originals placed on the original supporting portion and for feeding out the originals, a separating portion for separating the originals fed out by the feeding means and feeding them one by one to the image reading means, regulating means provided between the separating portion and the feeding means and movable to a regulating position in which it regulates the originals placed on the original supporting portion coming to the separating portion before the feeding operation by the feeding means, and a retracted position in which it does not hamper the feeding of the originals during the feeding operation of the feeding means, interlocking means for moving the regulating means to the retracted position in operative association with the movement of the feeding means to a feeding position in which it contacts with the originals when the feeding means feeds out the originals, and moving the regulating means to the regulating position in operative

association with the movement of the feeding means to  
a feeding stop position in which the feeding means  
becomes spaced apart from the originals, and a  
movable holding member for holding the feeding means  
5 for rotation and for movement toward and away from  
the originals, and the interlocking means is provided  
with a first link member movable in operative  
association with the movement of the holding member,  
and a second link member movable in operative  
10 association with the movement of the first link  
member to thereby move the regulating means to the  
regulating position or the retracted position.

Also, according to the present invention, the  
first link member or the holding member is formed  
15 with a cam shape, and the amount of movement of the  
regulating means moved through the intermediary of  
the second link member in conformity with the amount  
of movement of the holding member is varied by the  
cam shape.

20 Also, the image reading apparatus according to  
the present invention is provided with a guide member  
provided above the original supporting portion and  
below the feeding means located at the feeding stop  
position for guiding the originals fed out by the  
25 feeding means, and the cam shape is such a shape that  
 $H > h$ , where  $H$  is the amount of movement of the  
regulating means until the feeding means protrudes

downwardly from the guide member through the holding member when it feeds out the originals, and h is the amount of movement of the regulating means after the feeding means has protruded downwardly from the guide member.

Also, the image reading apparatus according to the present invention is provided with an openable and closable cover having the guide member provided on the underside thereof, and the first link member and the second link member are movably mounted on the openable and closable cover, and with the opening operation of the openable and closable cover, the regulating means is moved to the retracted position together with the second link member.

Also, according to the present invention, the second link member is provided with a restraining portion for restraining the holding member to thereby regulate the downward movement of the holding member when the openable and closable cover is opened.

Also, according to the present invention, the openable and closable cover opens the separating portion.

Also, according to the present invention, an image forming apparatus is provided with one of the image reading apparatuses described above, and an image forming portion for forming an image on the basis of image information read by the image reading

apparatus.

As described above, according to the present invention, design is made such that when the original is to be fed out, the regulating member is moved to the retracted position in operative association with the movement of the feeding means to the feeding position, and is moved to the regulating position in operative association with the movement of the feeding means to the feeding stop position, whereby there can be provided an image reading apparatus provided with regulating means which is inexpensive and compact and improved in a jam treating property, and an image forming apparatus provided with the same.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 schematically shows the construction of an image reading apparatus according to an embodiment of the present invention.

Fig. 2 is a driving block diagram of an original feeder provided in the image reading apparatus.

Fig. 3 is an enlarged view of the surroundings of the sheet feeding portion of the original feeder.

Fig. 4 shows a state when the number of originals set in the sheet feeding portion is small.

Fig. 5 shows a state when the number of originals set in the sheet feeding portion is great.

Fig. 6 is a view for illustrating the present invention.

Fig. 7 is another view for illustrating the present invention.

5        Fig. 8 shows a state when an openable and closable cover provided in the image reading apparatus has been opened.

Fig. 9 schematically shows the construction of an image forming apparatus provided with the image  
10    reading apparatus.

Fig. 10 schematically shows the construction of a conventional image reading apparatus.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

15        An embodiment of the present invention will hereinafter be described in detail with reference to the drawings.

Fig. 1 schematically shows the construction of an image reading apparatus according to the  
20    embodiment of the present invention. In the present embodiment, the image reading apparatus is of a type in which an original can be moved in a sub-scanning direction with an optical system fixed to thereby effect reading.

25        In Fig. 1, the reference character designates an image reading apparatus, the reference numeral 1 denotes an original feeder disposed in the upper

portion of the image reading apparatus 1A, and the reference numeral 100 designates a reading housing portion. This reading housing portion 100 is provided with a contact-type image sensor 102 which  
5 is image reading means for applying light to the image information surface of an original from an LED array as a light source for illuminating the original, and causing reflected light reflected by the image information surface to be imaged on a sensor element  
10 by a SELFOC lens (trademark) to thereby read image information.

Also, the original feeder 1 is provided with an original tray 2 which is an original supporting portion on which the original is placed, a pickup  
15 roller 3 which is feeding means provided at a location opposed to the original for movement in a vertical direction, a separating portion provided downstream of the pickup roller 3 and comprised of a separating pad 4 and a separating roller 5, and a  
20 pair of registration rollers provided downstream of the separating roller 5 and comprising a registration roller 6 and a driven roller 7 for correcting the skew feeding of the original.

The pickup roller 3 is rotatably mounted on the  
25 tip end portions of arms 19 (front) and 20 (rear) which are holding members pivotally (movably) mounted on the rotary shaft 33 of the separating roller 5

shown in Fig. 2 which will be described later,  
through a shaft 35, and is adapted to contact with or  
be spaced apart from the original by the vertical  
pivotal movement of the arms 19 and 20 resulting from  
5 the rotation of the separating roller 5.

The reference numeral 41 denotes an original  
set sensor provided between the pickup roller 3 and  
the separating roller 5 for detecting the presence or  
absence of the original on the original tray 2, and  
10 the reference numeral 42 designates an ante-  
registration sensor provided between the separating  
roller 5 and the pair of registration rollers 6 and 7  
for determining an amount of conveyance for the  
separating roller 5 to convey the original to the  
15 pair of registration rollers 6 and 7.

The reference numeral 8 denotes a platen roller  
provided downstream of the pair of registration  
rollers 6 and 7 for conveying the original while  
urging the original against the platen glass 101 of  
20 the reading housing portion 100, and downstream of  
this platen roller 8, there are provided a pair of  
conveying rollers comprising a conveying roller 9 and  
a driven roller 10 for discharging the original on  
the platen glass 101. Further, downstream of the  
25 pair of conveying rollers 9 and 10, there are  
provided a pair of sheet discharging rollers  
comprising a sheet discharging roller 11 and a driven

roller 12 for discharging the original to a discharging tray 18 through a surface reverse path Pr.

Here, by the provision of such a surface reverse path Pr, the discharging tray 18 can be provided above the original tray 2 and therefore, without the discharging tray 18 jumping out to the right and left outer sides of the original feeder 1, the installation space for the original feeder 1 can be made small. The reference numeral 13 designates a shutter, and the reference numeral 14 and 15 denote a second shutter link and a first shutter link for moving the shutter 13 to a position for restraining the original or a position for permitting the entry of the original.

The driving of each roller provided in the original feeder 1 will now be described with reference to Fig. 2.

In Fig. 2, the reference numeral 21 designates a driving motor, and a first pulley 23 mounted on the rotary shaft of this driving motor 21 is connected to a pulley 61 on a sheet feeding drive shaft 43 which is the center of pivotal movement of an openable and closable cover 51 (see Fig. 1) through a timing belt 62. Also, a pulley 25 disposed on the central portion of the sheet feeding drive shaft 43 is connected to a pulley 26 disposed on a separating roller shaft 33 through a timing belt 27.



The pulley 26 disposed on the separating roller shaft 33 is in turn connected to a pulley 29 disposed on a pickup roller shaft 35 through a timing belt 30, whereby the drive of the driving motor 21 is  
5 transmitted to the pulley 29 through the pulley 26.

The rotative driving of the pulley 26 is designed to be transmitted to the separating roller 5 through a one-way clutch 24, and design is made such that by the one-way clutch 24, drive is transmitted  
10 to the separating roller 5 in a counter-clockwise direction as viewed in Fig. 1, but the drive is not applied in a clockwise direction.

Also, the rotative driving of the pulley 29 disposed on the pickup roller shaft 35 is transmitted  
15 through a coupling portion 32 to the pickup roller shaft 35 of the pickup roller 3 rotatably supported on the tip end portions of the arm (front) 19 and arm (rear) 20 pivotally movable about the separating roller shaft 33.

20 On the pickup roller shaft 35, a friction member 31 is provided between the pulley 29 and the arm 20, and this friction member 31 is biased toward the arm 20 side by a compression spring (not shown). Thereby, the pulley 26 is rotated in a counter-  
25 clockwise direction and the pulley 29 is rotated in a counter-clockwise direction through the intermediary of the timing belt 30, whereupon the arm 20 and the

arm 19 are pivotally moved in a counter-clockwise direction (downward direction) about the separating roller shaft 33 by the sliding load of the friction member 31 and as the result, the pickup roller 3  
5 comes into contact with the original, whereupon the pickup roller 3 is rotated in a counter-clockwise direction against the sliding load of the friction member 31.

Also, when the pulley 26 is rotated in a  
10 clockwise direction and the pulley 29 is rotated in a clockwise direction through the intermediary of the timing belt 30, the arm 20 and the arm 19 are pivotally moved in a clockwise direction (upward direction) about the separating roller shaft 33 by  
15 the sliding load of the friction member 31 and as the result, the pickup roller 3 becomes spaced apart from the original.

Description will now be made of a driving system for the registration roller 6, the platen  
20 roller 8, the conveying roller 9 and the sheet discharging roller 11.

A second pulley 22 is mounted on the rotary shaft of the driving motor 21, and this second pulley 22 is connected to a pulley 63 through a timing belt  
25 64. Also, a one-way clutch 65 provided on the shaft of the registration roller 6 is connected to the pulley 63, and only the drive in a direction opposite

to the driving direction of the separating roller 5 is transmitted to the registration roller 6 by the one-way clutch 65.

That is, during the forward rotation of the driving motor 21, the separating roller 5 receives drive in a counter-clockwise direction, but the drive is not transmitted to the registration roller 6. Also, during the reverse rotation of the driving motor 21, the drive is not transmitted to the separating roller 5, but yet the drive is transmitted to the registration roller 6 in a clockwise direction.

Also, a pulley 66 is provided on one end of the shaft of the registration roller 6, and this pulley 66 is connected to a pulley 67 on the shaft of the platen roller 8 through a timing belt 68. Further, two pulleys 69 and 72 disposed on the other end of the shaft of the registration roller 6 are connected through timing belts 71 and 74, respectively, to a pulley 70 provided on the shaft 9a of the conveying roller 9 and a pulley 73 provided on the shaft 11a of the sheet discharging roller 11, respectively. Thereby, the drive of the driving motor 21 is transmitted to the conveying roller 9 and the sheet discharging roller 11.

The original conveying operation of the original feeder 1 provided with such a driving system will now be described with reference to Fig. 1.

When originals are set on the original tray 2 with the image surface thereof facing down, the original set sensor 41 is turned on, and by a detection signal from this original set sensor 41, a control portion (not shown) detects the presence of the originals on the original tray 2. When here, a start button, not shown, is depressed, the driving motor 21 is first rotated in a forward direction by a driving signal from the control portion, and together therewith, the pickup roller 3 is lowered and comes into contact with the originals, whereafter the pickup roller 3 is rotated in a counter-clockwise direction which is an original conveying direction, thereby conveying the originals to the separating portion 4, 5.

Next, the originals are separated one by one in this separating portion 4, 5, and the separated original is dashed against the pair of registration rollers 6 and 7 which are not being driven, whereafter the original forms a predetermined amount of loop, whereupon the driving motor 21 is stopped to thereby once stop the conveyance. Thereafter, the driving motor 21 is rotated in a reverse direction by the driving signal from the control portion, whereby the registration roller 6, the platen roller 8, the conveying roller 9 and the sheet discharging roller 11 are rotated.

Thereby, the original is conveyed while being in close contact with the platen glass 101, and is exposed to light by illuminating means, not shown, whereby the reading of the original is effected.

5    Thereafter, the original passes the platen roller 8, whereupon the reading is terminated, and the driving motor 21 is stopped, whereby the first original is stopped while being nipped between the pair of sheet discharging rollers 11 and 12.

10       Next, the driving motor 21 is again rotated in the forward direction by the driving signal from the control portion to thereby feed the second original, whereafter like the first original, the second original is dashed against the pair of registration  
15   rollers 6 and 7 being at a halt, whereby a predetermined amount of loop is obtained and the driving motor 21 is stopped to thereby once stop the conveyance. Thereafter, the driving motor 21 is again rotated in the reverse direction by the driving  
20   signal from the control portion and the registration roller 6, the platen roller 8, the conveying roller 9 and the sheet discharging roller 11 are rotated, whereupon the reading of the second original is effected and the first original is discharged onto  
25   the sheet discharging tray 18 by the pair of sheet discharging rollers 11 and 12.

The above-described operation is continued and

when the original set sensor 41 is turned off during the reading of the last original, the control portion detects the exhaustion of the originals on the original tray 2. When the exhaustion of the originals is detected in this manner, the driving of the driving motor 21 is continued still after the termination of the reading, whereby the last original is discharged onto the sheet discharging tray 18 by the pair of sheet discharging rollers 11 and 12.

Fig. 3 is a cross-sectional view of the surroundings of the sheet feeding portion, and as shown in Fig. 3, the shutter 13 which is regulating means is pivotally mounted on the end of the pivotal movement of the first shutter link 15 which is a second link member, and is located between an openable and closable cover rib 51a which is a guide member provided on the underside of the openable and closable cover 51 forming an upper conveying guide and a lower conveying guide 52 present on the extension of the original tray 2.

The openable and closable cover 51 is pivotally movable in a vertical direction about the sheet feeding drive shaft 43, and design is made such that when this openable and closable cover 51 is opened by being upwardly pivotally moved, the pad 4 and the separating roller 5 become spaced apart from each other.

Also, the first shutter link 15 is pivotally (movably) on the openable and closable cover 51 by a pivotal movement center 15a, and the second shutter link 14 which is a first link member is pivotally (movably) mounted on the openable and closable cover 51 by a pivotal movement center 14a.

When as already described, the driving motor 21 is rotated in the forward direction and the separating roller 5 and the pickup roller 3 are rotated in the counter-clockwise direction and the arm 19 is pivotally moved in the counter-clockwise direction, the cam surface 14b of the second shutter link 14 is pressed and depressed by the lever portion 19a of the arm 19 with the pivotal movement of this arm 19 because the arm 19 is provided with the lever portion 19a.

Thereby, the second shutter link 14 is pivotally moved in the clockwise direction. This second shutter link 14 is provided with a lever 14c, and when the second shutter link 14 is thus pivotally moved, the lever 15b of the first shutter link 15 is pushed up by the lever 14c of the second shutter link 14c, whereby the first shutter link 15 is pivotally moved in the counter-clockwise direction.

When the first shutter link 15 is thus pivotally moved in the counter-clockwise direction, the shutter 13 is raised upwardly from the original

regulating position and is retracted to above the openable and closable cover rib 51a, as shown in Fig. 4. Thereby, even if the sheet feeding operation is performed thereafter, it will never happen that the shutter 13 hampers the feeding-out of the original. When thereafter, the driving motor 21 is rotated in the reverse direction, the arm 19 is rotated in the clockwise direction and together therewith, the shutter 13 falls with the gravity of the shutter 13 and returns to a position shown in Fig. 3.

In case where as described above, the original is fed out by interlocking means constituted by the first shutter link 15, the second shutter link 14 and the arm 19, the shutter 13 is moved to the retracted position in operative association with the movement of the pickup roller 3 to the feeding position in which it contacts with the original, and the shutter 13 is moved to the regulating position in operative association with the movement of the pickup roller 3 to the feeding stop position in which it is spaced apart from the original, whereby driving means (such as a solenoid) exclusively for moving up and down the shutter can be disused to thereby achieve a reduction in cost.

Further, because of a construction in which two systems of transmitting means are not used, but the two link members 14 and 15 are simply added, it is



possible to achieve the simplification of the driving system, the curtailment of the number of parts such as gears, timing belts and shafts, and the saving of space (downsizing).

5           Now, Fig. 4 shows a state when the number of originals set on the original tray 2 is small (the thickness of a bundle is small). When like this, the thickness  $t_1$  of the bundle of set originals P is small; the pickup roller 3 is lowered by the angle  $\theta_1$   
10 from a dots-and-dash line position to a solid line position in Fig. 4.

On the other hand, Fig. 5 shows a state when the number of originals set on the original tray 2 is great (the thickness of a bundle is great). When  
15 like this, the thickness  $t_2$  of the bundle of set originals P' is great, the pickup roller 3 is pivotally moved by the angle  $\theta_2$  from a dots-and-dash line position (retracted position) to a solid line position in Fig. 5.

20           That is, when the thickness of the bundle of set originals is small ( $t_1$ ), the amount of pivotal movement (the amount of downward movement) of the pickup roller 3 becomes great ( $\theta_1$ ), and when the thickness of the bundle is great ( $t_2$ ), the amount of  
25 pivotal movement (the amount of downward movement) of the pickup roller 3 becomes small ( $\theta_2$ ).

Accordingly, when the bundle of originals P is

thick (t2), the amount of pivotal movement of the arm 19 in the counter-clockwise direction becomes small and along therewith, the amounts of pivotal movement of the second shutter link 14 and the first shutter link 15 also become small and therefore, the amount of upward retraction of the shutter 13 becomes small.

In the present embodiment, however, as shown in Fig. 5, the cam surface 14b of the second shutter link 14 is formed with a cam shape 14d of a steep gradient so that even when the amount of pivotal movement of the arm 19 is small as described above, the shutter 13 can be retracted upwardly from the openable and closable cover rib 51a.

When as described above, the cam surface 14b of the second shutter link 14 is formed with the cam shape 14d of a steep gradient and the arm 19 is pivotally moved in the counter-clockwise direction, the lever portion 19a of the arm 19 presses this cam shape 14d of a steep gradient, whereby the second shutter link 14 and the first shutter link 15 can be greatly pivotally moved.

Thereby, the shutter 13 can be sufficiently retracted even when the amount of pivotal movement of the arm 19 is small. In Fig. 5, the dots-and-dash line indicates the original regulating position of the shutter 13, and H indicates a distance over which the shutter 13 has been moved to a position indicated

by a solid line above the openable and closable cover rib 51a by the construction as described above until the pickup roller 3 protrudes downwardly from the openable and closable cover rib 51a through the  
5 intermediary of the arm 19.

Now, after the shutter 13 has been retracted to above the openable and closable cover rib 51a as described above, the amount of retraction of the shutter 13 may be small. Fig. 6 shows a case where  
10 the cam surface 14b of the second shutter link 14 is formed with only the cam shape 14d of a steep gradient, and in the case of such a construction, the amount of retraction (movement) h of the shutter 13 after it has cleared the openable and closable cover  
15 rib 51a becomes great.

When the amount of retraction h of the shutter 13 becomes great as described above, the top surface 51c of the openable and closable cover 51 must be raised to a position indicated by 51c' in Fig. 6 so  
20 that the uppermost portions of the shutter 13 and the first shutter link 15 may not collide with the top surface 51c. Also, along with this, the sheet discharging tray 18 and the pair of sheet discharging rollers 11 and 12 must also be raised to positions  
25 indicated by 18', 11' and 12', respectively, in Fig. 6, and this results in the bulkiness of the image reading apparatus and the great distance of the

conveying path, and also affects productivity.

In order not to reduce productivity, it is desirable to adopt a construction in which the location of the pair of sheet discharging rollers 11 and 12 is not raised (the distance of the conveying path is not lengthened). When the location of the pair of sheet discharging rollers 11 and 12 is not raised as described above, it is necessary to make a discharged sheet stacking surface 51b relatively low, but sometimes the discharged sheet stacking surface 51b cannot be made low depending on the disposition of the shutter 13 and the first shutter link 15 or the like. In that case, as shown in Fig. 7, the slope of the discharged sheet stacking surface 51b" of the openable and closable cover 51 becomes steep as compared with the conventional discharged sheet stacking surface 51b and therefore, a discharged sheet stacking property is aggravated.

So, in the present embodiment, as shown in Fig. 4, below the cam shape 14d of the second shutter link 14, there is formed a cam shape 14e having a gradient opposite in direction to the cam shape 14d. Design is made such that after below the cam shape 14d, the cam shape 14e having a gradient opposite in direction thereto has been formed as described above, and the shutter 13 has been retracted to above the openable and closable cover rib 51a, the lever portion 19a of

the arm 19 presses this cam shape 14e, whereby even  
if thereafter the arm 19 is pivotally moved, the  
amounts of pivotal movement of the second shutter  
link 14 and the first shutter link 15 can be made  
5 small.

Thereby, the amount of retraction (movement) h  
of the shutter 13 to the openable and closable cover  
rib 51a and so on can be made small, and without the  
height of the openable and closable cover top surface  
10 51c being increased, the uppermost portions of the  
shutter 13 and the first shutter link 15 can be  
prevented from colliding with the openable and  
closable cover top surface 51c.

As described above, the cam surface of the  
15 second shutter link 14 is formed with the cam shape  
14d of a steep gradient and the cam shape 14e having  
a gradient opposite in direction to the cam shape 14d,  
whereby when the original is to be fed out, the  
amount of movement H of the shutter 13 until the  
20 pickup roller 3 protrudes downwardly from the  
openable and closable cover rib 51a through the  
intermediary of the arm 19 can be made great.  
Thereby, the shutter 13 can be sufficiently retracted  
even when the amount of downward movement of the  
25 pickup roller 3 is small as when the thickness of the  
bundle of originals is great.

Also, the amount of movement h of the shutter

13 after the pickup roller 3 has protruded downwardly from the openable and closable cover rib 51a can be made small. That is, design is made such that due to the two cam shapes 14d and 14e, the relation between  
5 H and h becomes  $H > h$  and therefore, the amount of retraction of the shutter 13 is made great within a range which can cope with even the case where the thickness of the bundle is great, and the amount of retraction is made small when the shutter 13 has been  
10 sufficiently retracted, whereby without the top surface of the openable and closable cover 51 being heightened, the first shutter link 15 and the second shutter link 14 can be disposed. Accordingly, the bulkiness and reduced productivity of the image  
15 reading apparatus can be prevented and further, a reduction in the discharged sheet stacking property of the openable and closable cover 51 serving also as the discharged sheet stacking surface can be prevented.

20 While in the foregoing, description has been made of the case where the second shutter link 14 is formed with the cam surface, a similar effect can also be obtained even if the lever portion 19a of the arm 19 is formed with a cam shape of such a  
25 construction as described above.

Now, when the original in the sheet feeding portion is jammed as already described, the openable

and closable cover 51 is pivotally moved in a clockwise direction about the sheet feeding drive shaft 43, as shown in Fig. 8, and the pressure contact between the separating roller 5 and the  
5 separating pad 4 is released, whereby the original jammed in the sheet feeding portion can be easily pulled out leftwardly.

When as described above, the openable and closable cover 51 is pivotally moved in a clockwise  
10 direction about the sheet feeding drive shaft 43, the pulley 25 on the sheet feeding drive shaft is relatively rotated in a counter-clockwise direction. When the pulley 25 is thus rotated in the counter-clockwise direction, the pulley 29 is rotated in a  
15 counter-clockwise direction through the intermediary of the timing belt 27, the pulley 26 and the timing belt 30, and together therewith, as already described, the arm 19 is pivotally moved in the counter-clockwise direction by the sliding load of the  
20 friction member 31 and as the result, as shown in Fig. 8, the shutter 13 is upwardly retracted.

Thereby, it never happens that the shutter 13 hangs down with the aid of gravity when the openable and closable cover 51 is opened and a jammed original  
25 is pulled out, and the shutter 13 can be prevented from being caught by the original to thereby hamper the pulling-out of the original.

On the other hand, there is a case where at this time, the arm 19 is rotated too much in a counter-clockwise direction and the pickup roller 3 tends to be lowered. In the present embodiment, however, as shown in Fig. 8, a stopper portion 14f which is a restraining portion is provided on the lower end portion of the second shutter link 14, and when the pickup roller 3 tends to be lowered as described above, the lever portion 19a of the arm 19 is adapted to be restrained by this stopper portion 14f. Thereby, it never happens that the pickup roller 3 is lowered too much and hampers jam treatment.

As described above, the shutter 13 can be upwardly retracted in operative association with the pivotal movement of the openable and closable cover 51 and therefore, when the original jammed in the sheet feeding portion is to be pulled out, the jammed original can be pulled out without being struck against the shutter 13, whereby the original can be prevented from being damaged when it is pulled out.

Now, while the construction of the single body of an image reading apparatus has hitherto been described, of course the present invention can also be applied to an image reading apparatus 1 provided on an image forming apparatus (digital copying machine) as shown in Fig. 9.



In Fig. 9, the reference numeral 400 designates a digital copying machine, the reference character 400A denotes a digital copying machine main body (hereinafter referred to as the apparatus main body),  
5 the reference numeral 401 designates an image forming portion disposed in the central portion of the apparatus main body 400A, and the reference numeral 301 denotes a sheet feeding portion for conveying a sheet to the image forming portion 401.